Colville River Fecal Coliform Total Maximum Daily Load Study

The Colville River Basin

- Drains 1016 sq mi of land – only 8 sq mi outside of Stevens County
- The basin makes up 41% of Stevens County land area
- Averages 17.2 inches of rain per year with 2/3 falling between October and March

Colville River Discharge Statistics

- Highest flow occurs in April averaging 853 cubic feet per second (cfs) at Kettle Falls
- Lowest flow occurs in August averaging 90.2 cfs at Kettle Falls
- The average annual discharge at Kettle Falls is 311 cfs
- Chewelah Creek, Little Pend Oreille River, and Mill Creek account for over 50% of the flow

Colville River Basin Land Cover

- Forests/Shrublands/Woody Wetlands/Upland Grasses 82%
- Agriculture 10%
- Barren Ground 6%
- Urban/Residential/Commercial/Industrial/Transportation 1%
- Open Water/Herbaceous Wetland 1%

Problem Statement

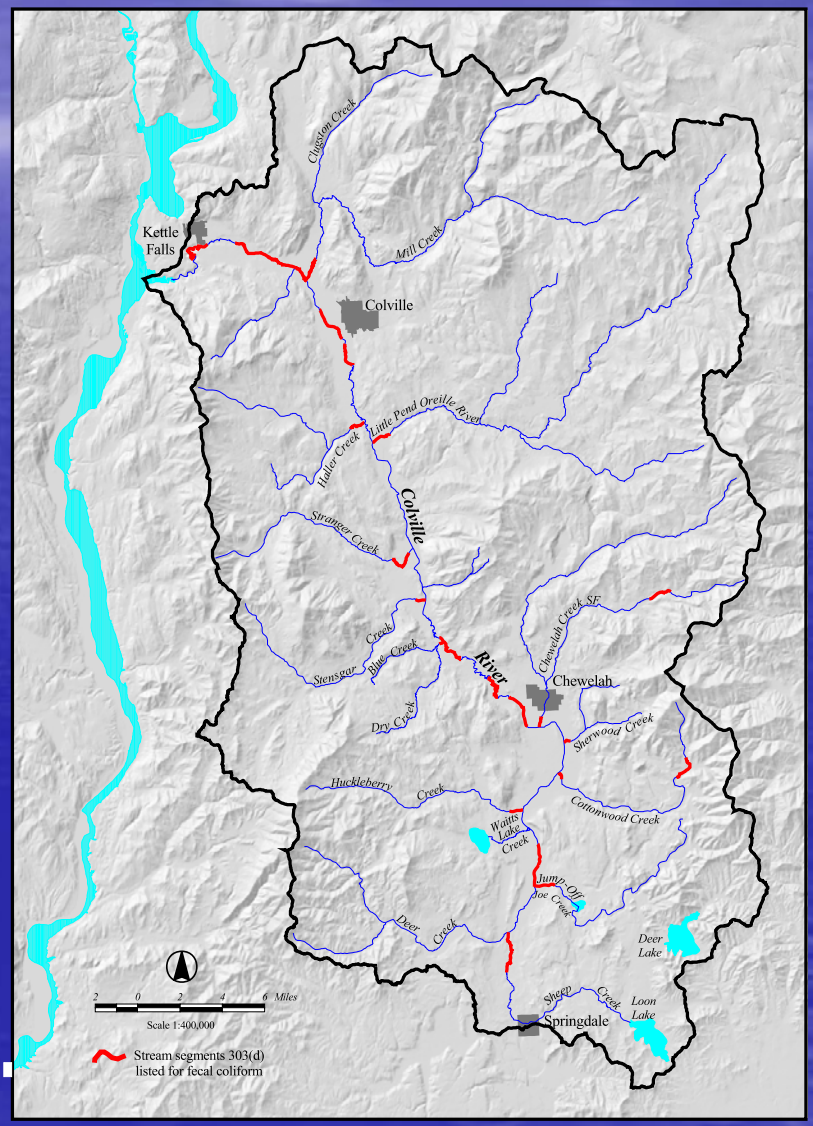
- High bacteria counts during summer months violate water quality standards and do not support beneficial uses like swimming and fishing

The Class A Water Quality Standard for Fecal Coliform in Surface Waters

- Freshwater – fecal coliform organism levels shall both not exceed a geometric mean value of 100 colonies/100 mL, and not have more than 10 percent of all samples obtained for calculating the geometric mean value exceeding 200 colonies/100 mL.

1998 303(d) List for Fecal Coliform

- 9 Colville River Segments
- 15 Tributary Segments



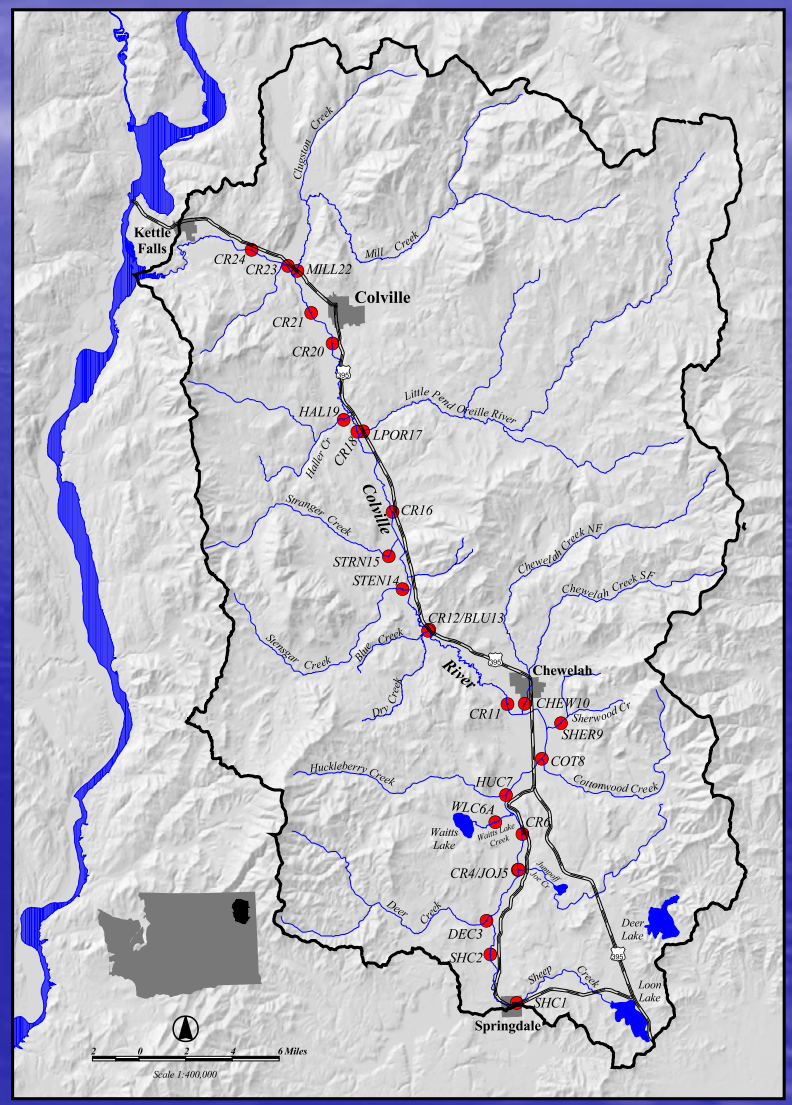
Colville River and tributary segments 303(d) listed for fecal coliform.

Goals and Objectives

- Characterize FC bacteria density and loads in the Colville River and tributaries;
- Identify relative contributions of FC loading from near-shore and tributaries to the Colville River; and
- Establish load reductions from nonpoint sources to support a TMDL as required under section 303(d) of the federal Clean Water Act

Methods

- FC samples were collected from 10 mainstem and 15 tributary sites
- Sampling occurred every two weeks from March 2000 through March 2001
- Flow data was used from the USGS station at Kettle Falls and five gaging stations developed by Ecology



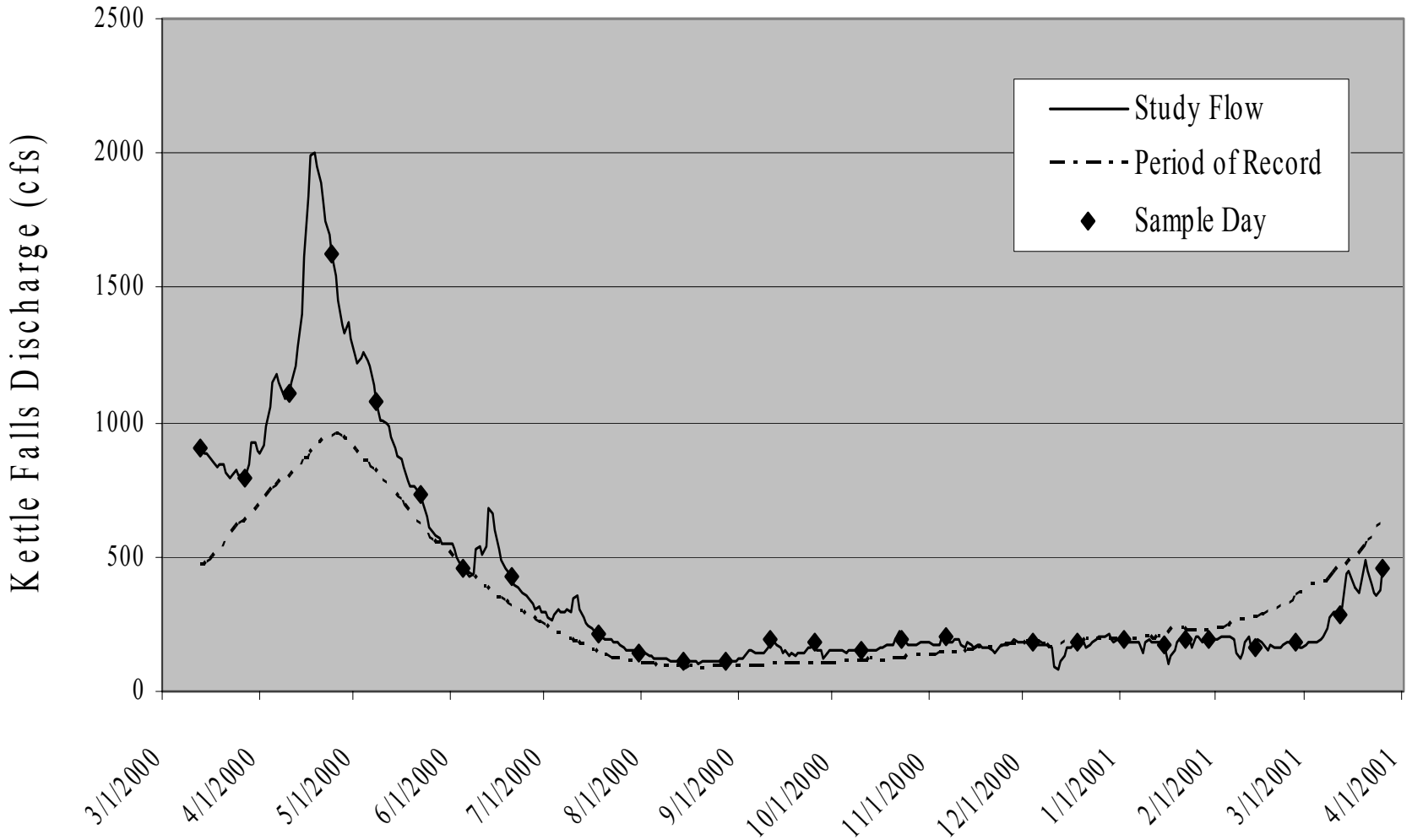
Quality Assurance/Quality Control

- 10-20% of all samples were replicated
- The percent difference (RMSCV) was calculated for sample pairs
- Field replicates had a 28% difference for the study

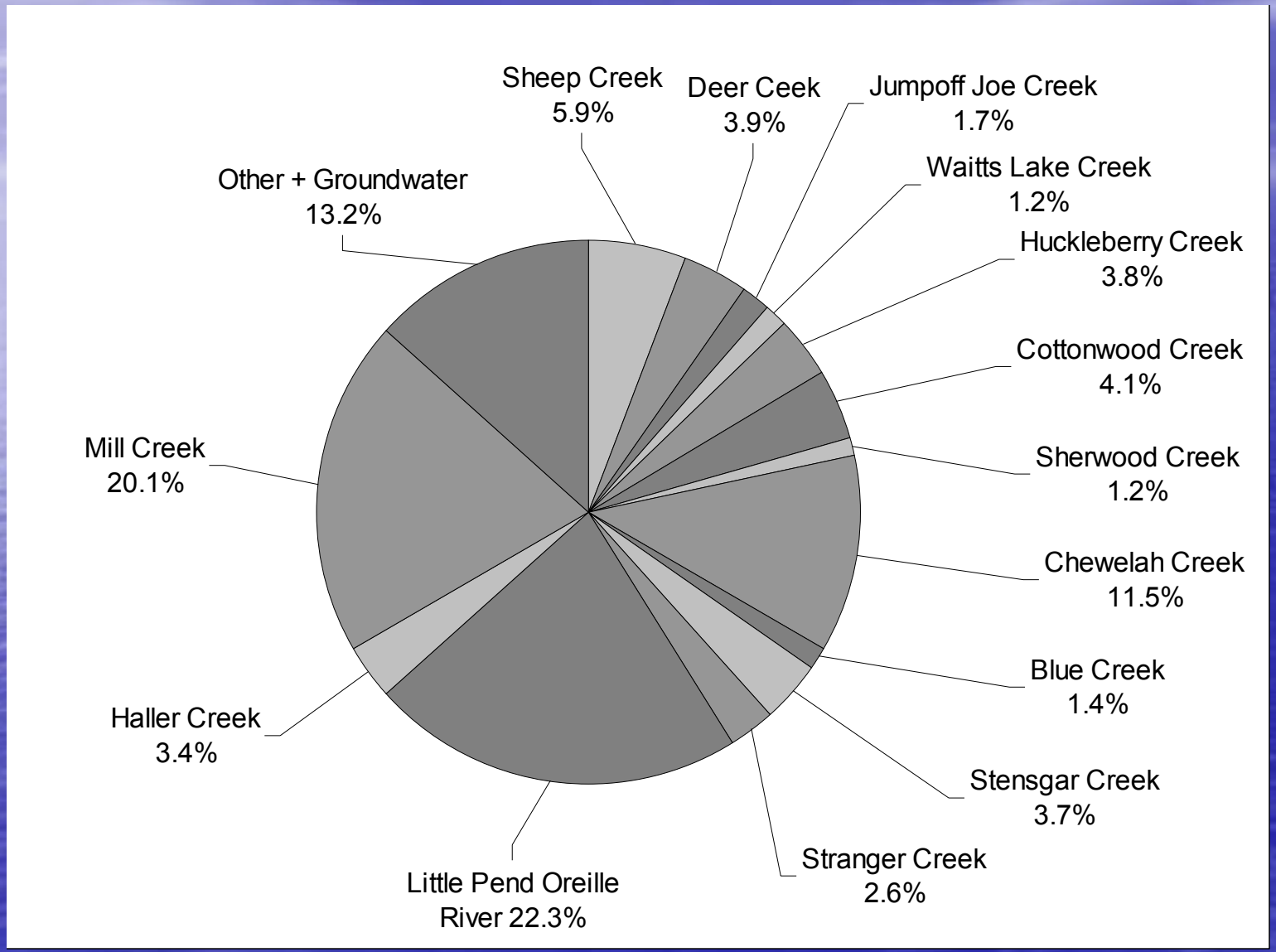
Study Period Discharge

- Average annual flow at Kettle Falls is 311 cfs
- Mean study flow was 394 cfs – 27% above average
- Chewelah Creek, Little Pend Oreille River, and Mill Creek accounted for an average of 54% of Colville River discharge at Kettle Falls during the study
- Sheep Creek, a headwater stream, is the only other stream with a greater than 5% contribution at 5.9%

Annual Stream Flow



Colville River Water Balance March 2000 - March 2001



Water Quality Results

- All mainstem sites except Colville River at Greenwood Loop Road (CR24) violated both levels of the WQ standard for fecal coliform during summer months
- All tributary sites except Sheep Creek in Springdale (SHC1) violated the 2nd level of the WQ standard for fecal coliform during summer months

June through September is the period with the highest FC counts

- The Colville at Betteridge Road (CR4) and the Colville at Valley (CR6) had the highest FC counts in the upper basin (above RM 50)
- Blue Creek (BLU13) and Stranger Creek (STRN15) had the highest FC counts in the middle basin (from RM 30 to RM 50)
- The lower basin had summer problems but dilution likely moderated higher values

Table B1. Fecal coliform results for the Colville River Fecal Coliform TMDL Study, March 13, 2000 - March 27, 2001.

DATE	CR 24	CR 23	MILL22	CR 21	CR 20	HAL 19	CR 18	LPOR 17	CR 16	STRN 15	STEN 14	BLU 13	CR 12	CR 11	CHEW 10	SHER 9	COT 8	HUC 7	WLC6A	CR 6	JOJ 5	CR 4	DEC 3	SCH 2	SCH 1
3/13/2000	6	3U	6	11	6	1U	6	2	8	14	47	**110**	15	9	5	13	4	1U	14	3	1U	3	6	8	5
3/27/2000	5	16	4	5	5	2	6	4	8	13	15	**150**	21	5	6	7	5	20	42	7	12	15	4	19	20
4/10/2000	40	15	29	14	15	24	27	1	24	30	29	**120**	38	4	35	1U	16	15	1U	15	1U	30	4	28	24
4/24-25/00	23	13	29	23	22	10	39	8	26	65	68	**270**	39	28	28	6	62	5	1	54	6	95	1U	**120**	46
5/8-9/00	17	10	22	8	30	6	24	17	39	**150J**	53	**380**	24	38	36	13	15	16	60	36	31	56	3	32	27
5/22-23/00	54	90	**110**	53	61	54	63	23	**110**	**150**	12	100	**170**	**120**	**130**	31	55	14	11	**270J**	60	**260J**	8	54	22
6/5-6/00	61	59	**180**	69	86	83	**120**	65	**170**	**330**	67	**850**	**210**	**230**	**200**	88	56	25	26	**260**	39	**360**	6	80	19
6/19-20/00	88	44	51	**110**	47	**3500J**	43	37	69	**390**	63	**420**	**180**	84	88	24	45	57	21	**370**	100	**480**	66	**180**	44
7/17-18/00	92	**130**	**120**	92	**170**	**120**	**360**	**140**	**180**	**1500**	**210**	120	**220**	**210**	**140**	100	**130**	84	89	**380**	**180**	**560**	**120**	**760**	82
7/31-8/1/00	44	**140**	**110**	**190**	**330**	**590**	**200**	**210**	**220**	**1800**	**660**	**180**	**280**	**260**	**230**	**230**	**170**	**280**	**870**	**700**	**330**	**1400**	**530**	**770**	**160**
8/14-15/00	81	**140**	96	96	**250**	**170**	**130**	**110**	**130**	**1200**	**640**	**220**	**140**	**240**	**220**	54	66	**300**	**600**	**530**	**180**	**1100**	100	**210**	**120**
8/28-29/00	100	**180**	**240**	**230**	**150**	**140**	**140**	40	**180**	**750**	**170**	**300**	**180**	**160**	51	29	**320**	**260**	**150**	**400**	**220**	**340**	23	**170**	31
9/11-12/00	**160**	**590**	84	**120**	**110**	26	**260**	37	**320**	**700**	**360**	**190**	**360**	**410**	**160**	**140**	**190**	**110**	**420**	**390**	96	**480**	**340**	**170**	21
9/25-26/00	57	38	41	46	96	23	29	25	34	**450**	31	**810**	**110**	**120**	88	**640J**	57	29	**120**	**250**	49	**260**	46	49	19
10/10-11/00	10	3	35	2	21	4	31	27	57	85	80	77	68	43	100	23	30	24	26	31	11	**210**	85	39	10
10/23-24/00	10	9	27	1	84	17	44	15	39	57	55	26	57	92	29	2	**120**	28	15	44	6	**150**	**230**	31	8
11/6-7/00	2	3	**110**	1U	16	56	27	8	24	51	**140**	**2200**	27	26	33	**1700**	26	49	4	29	1U	54	9	20	6
12/4-5/00	54	2	41	1U	4	2	6	5	96	**2000J**	9	50	35	44	16	3	6	4	64	**140**	2	**120**	1U	55	49
12/18-19/00	1U	2	51	1U	**	6	66	15	**150**	31	14	**140**	**200**	**	66	4	13	16	**	88	1U	80	8	45	52
1/2-3/01	42	55	**120**	**120**	5	8	9	20	31	92	46	**790J**	34	84	73	5	37	8	8	**540**	6	48	4	23	41
1/15-16/01	1U	1U	10	1U	1U	18	2	26	8	14	8	**440**	19	28	25	10	12	12	22	**170**	3	43	3	34	33
1/22-23/01	3	1	4	2	1	5	1	2	3	11	8	100	33	36	29	43	34	2	11	**150J**	5	37	5	49	26
1/29-30/01	33	6	**120**	3	17	6	28	24	11	9	32	**3700J**	26	31	15	**1000J**	11	3	11	**250**	29	34	1	36	37
2/13-14/01	36	25	3	65	10	7	13	16	14	86	15	**220**	9	2	47	26	19	2	1	4	4	2	2	23	44
2/26-27/01	14	4	8	48	10	12	9	40	2	19	5	9	88	1U	1U	2	7	51	4	58	5	12	1U	39	37
3/12-13/01	12	27	98	**120**	8	7	17	20	9	41	31	20	18	38	36	5	45	2	18	95	2	39	1	13	10
3/26-27/01	89	29	27	20	15	2	20	10	10	57	33	43	9	23	17	5	3	6	37	23	3	21	13	33	13

** = No sample - stream frozen

U = Analyte not detected at the detection limit shown

J = The number reported is an estimate, although the "true" value may be greater than or equal to the reported value

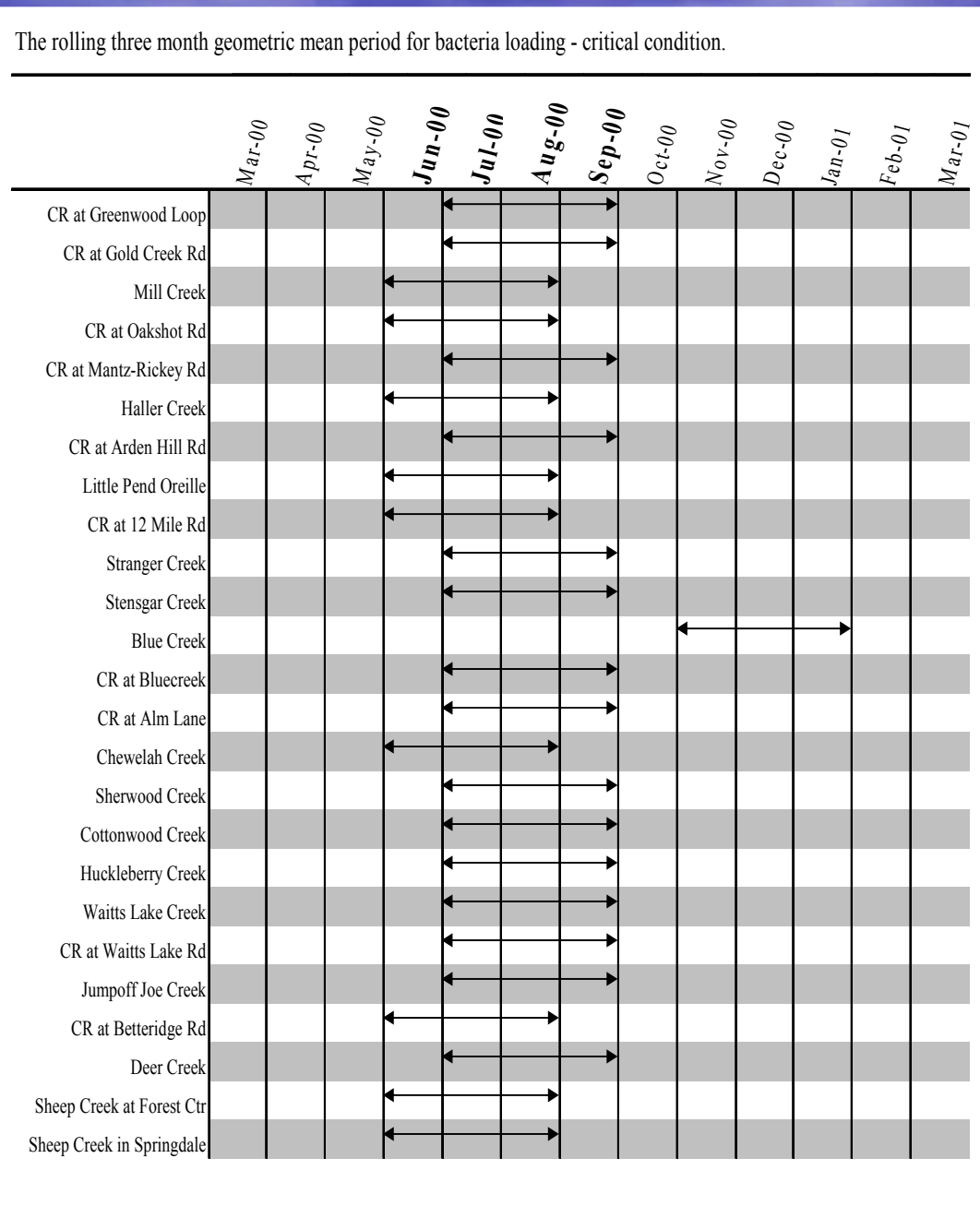
Bolded = Result is greater than the first criterion of the Class A water quality standard for fecal coliform bacteria (100 cfu/100 mL)

= Result is greater than the second criterion of the Class A water quality standard for fecal colidform bacteria (200 cfu/100 mL)

Critical Conditions

- The period when WQ is at it's worst
- The period implementation measures target
- For the Colville River this is the June through September months, except for Blue Creek (BLU13)

Highest three month geometric mean



Colville River FC reductions needed to meet WQ standards

- Load reductions range from 3% to 89%
- Based on two and three month rolling geometric means and 90th percentiles
- "Statistical Theory of Rollback" provides a percent reduction to meet WQ standards
- When applied to critical conditions it should be protective year around

Target reductions needed for the Colville River

Site	Geometric Mean	90th Percentile	Target Geometric Mean	Required Reduction
Betteridge Rd – CR4	736	1681	81	89%
Waitts Lake Rd – CR6	487	1220	78	84%
Gold Creek Rd – CR23	154	652	46	70%
Oakshot Rd - CR21	140	473	59	58%
Bluecreek - CR12	199	461	86	57%
Arden Hill Rd - CR18	146	453	64	56%
Alm Lane - CR11	217	381	98	55%
12 Mile Rd - CR16	174	427	80	54%
Mantz-Rickey Rd - CR20	214	362	98	54%
Greenwood Loop - CR24	93	205	90	3%

Tributary FC reductions needed to meet WQ standards

- Load reductions range from 4% to 95%
- Based on two and three month rolling geometric means and 90th percentiles
- "Statistical Theory of Rollback" provides a percent reduction to meet WQ standards
- When applied to critical conditions it should be protective year around

Target reductions needed for tributaries of the Colville River

Site	Geometric Mean	90th Percentile	Target Geometric Mean	Required Reduction
Haller Creek - HAL19	379	3387	19	95%
Sherwood Creek - SHER9	122	3403	6	95%
Blue Creek - BLU13	411	3261	25	94%
Stranger Creek - STRN15	1249	2385	100	92%
Sheep Creek - SHC2	380	1272	57	85%
Waitts Lake Ck - WLC6A	289	1168	49	83%
Stensgar Creek - STEN14	350	1010	70	80%
Deer Creek - DEC3	132	773	33	75%
Huckleberry Creek - HUC7	207	497	83	60%
Jumpoff Joe Creek - JOJ5	220	396	99	55%
Cottonwood Creek - COT8	147	358	81	45%
Chewelah Creek - CHEW10	154	338	91	41%
Mill Creek - MILL22	132	239	99	25%
Little PO River - LPOR17	107	264	80	25%
Sheep Creek - SHC1	84	209	81	4%

Margin of Safety

- A required component of a TMDL
- Accounts for the uncertainty of the analysis
- Expressed explicitly by a set aside or implicitly by using conservative assumptions

Follow-up Monitoring and Evaluation

- Assesses adequacy of control measures
- Guides future control actions
- Assures management measures are successful in meeting WQ standards

Conclusions and Recommendations

- All study river segments and tributaries require bacteria reductions during the dry season. Target reductions range from 3% to 95%.
- Further investigation will be needed in sub-basins and along the riparian corridor to develop site specific prescriptions for abatement measures.
- Farm plans should be developed for locations where sources are identified.
- The most obvious sources of bacteria inputs were from cattle directly accessing the streams. Grants and cost share loans should be supported for implementation of fencing and watering facilities.

- The area upstream and downstream of the CR at Betteridge Road should be evaluated as a priority. The CR4 (89%) and CR6 (84%) mainstem sites are the highest for reduction percentages.
- All mainstem segments had higher bacteria loads than tributaries.
- When setting priorities for corrective actions a ranking matrix should be used that includes issues like: degree of standard exceedance; bacteria load; 303(d) listing; recreational potential; local interest; public access; fish use and species.

- Colville and Chewelah WWTPs were not included in the study. Recent upgrades and reissue of permits should maintain compliance with WQ standards. The monitoring reports from the facilities should be reviewed annually to assure the new permits are not being violated.
- A long term monitoring program for the basin should be developed and supported. The effectiveness of controls need to be followed to assure compliance with TMDL targets.

Special Thanks to the Stevens County Conservation District

- Charlie Kessler, Tom Ledgerwood, and Claudia Michalke